

cdfSim Validation Package

Karen Gibson, Vivek Tiwari, Manfred Paulini

Carnegie Mellon University

Simulation Meeting

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Simulation Validation?

Validation? We don't need no stinking validation!?!

or

Yo mama's so simple, when she wants to validate her simulation, she opens the window and looks outside.

General Validation Overview

- ◆ Compare new releases of CDF software w/previous and/or reference releases
 - Make validation histograms comparing current & past performance of simulation
 - Validation code to be added to SimulationMods
- ◆ Detector sub-components validated
 - Calorimeter
 - Muon Systems
 - Silicon, COT
 - Tracking
 - ???

Detector Validation Overview

◆ Calorimeter

- Low energy π 's
 - ◆ $p=1, 2, 3, 4, 5 \text{ GeV}$
 - ◆ Towers 3 & 9
 - Central & face scan
- High energy π 's
 - ◆ $p=10, 57, 150 \text{ GeV}$
 - ◆ Towers 0-11
 - Central scan
- High energy e's
 - ◆ $p=10, 50, 100 \text{ GeV}$
 - ◆ Towers 0-11
 - Central scan

◆ Muon Systems

- Low p_T ($=1.5\text{-}5 \text{ GeV}$) & high p_T ($=40 \text{ GeV}$) μ 's
 - ◆ CMU, CMP, CMUP, CMP

◆ Silicon, COT

- $p_T=15 \text{ GeV}$ μ 's
 - ◆ Cluster length, charge for all Si layers
 - ◆ para., geo., phys. CDM
 - ◆ #hits/SL for all SL

◆ Tracking

- $p_T=15 \text{ GeV}$ μ 's
- ttbar (Herwig)

MC generated w/FakeEv unless otherwise specified

Where Are We?

- ➡ Calorimeter
- ◆ Muon Systems
- ◆ Silicon, COT
- ◆ Tracking

Calorimeter

◆ π' s

- Low energy scan (towers 3 & 9)

- ◆ E/p , E_{em}/p , E_{had}/p , E_{em}/E_{had} , f_{zeros}
- ◆ $\langle E_{total}/p \rangle$, $\langle E_{em}/p \rangle$, $\langle E_{had}/p \rangle$ vs. p

- High energy scan (towers 0-11)

- ◆ E_{total} , E_{em} , E_{had} , E_{em}/E_{had} , E_{had} (MIP $E_{em} < 0.6$),
 E_{em} (MIP $E_{em} < 1.0$)

◆ e's

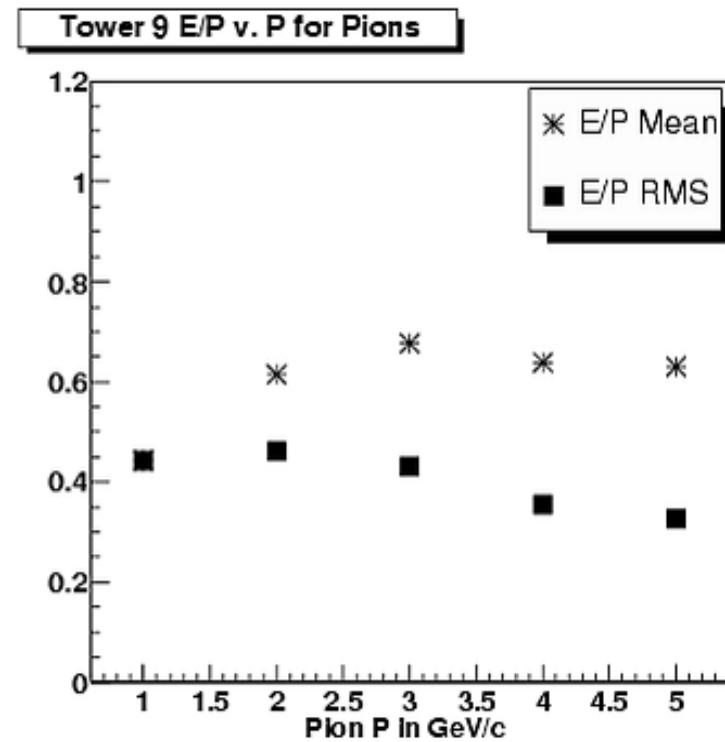
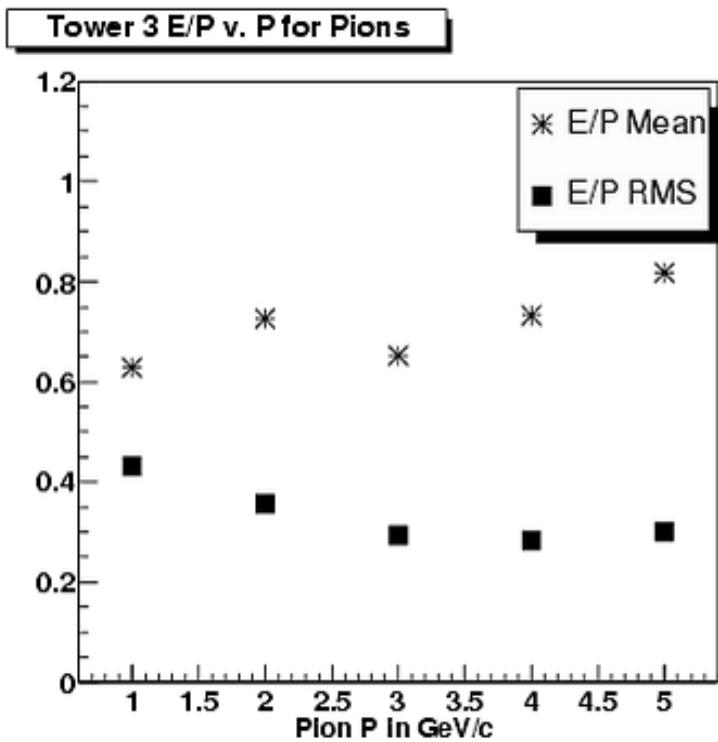
- High energy scan

- ◆ E_T , p_T , E_{em} , E/p , E_{had}/E_{em} , LSHR, FIDELE
- ◆ CES

- E_{wire}/p , E_{strip}/p , χ^2_{strip} , χ^2_{wire} , $\Delta r\varphi$, ΔZ

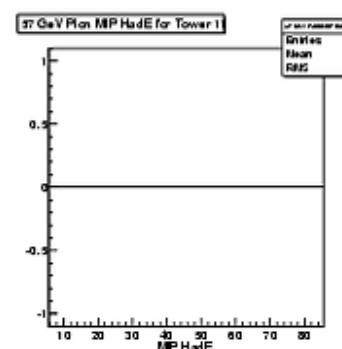
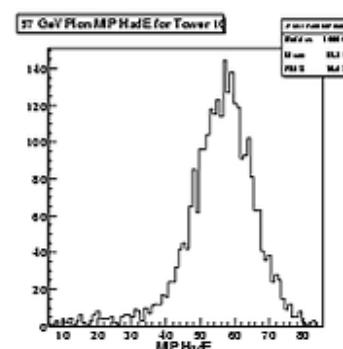
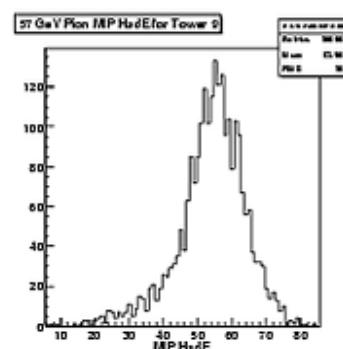
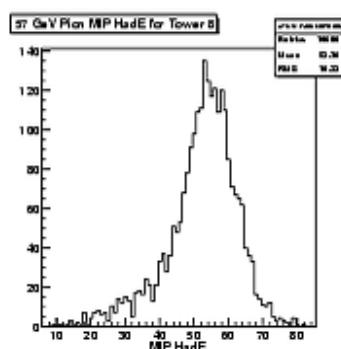
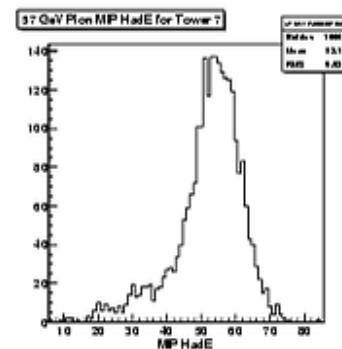
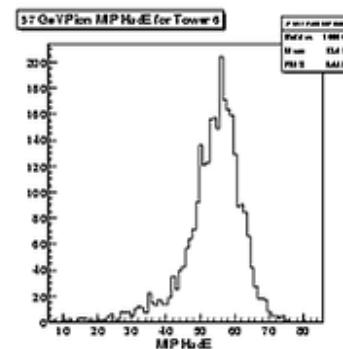
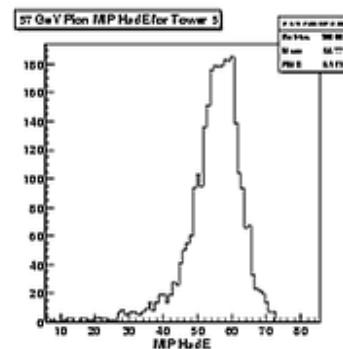
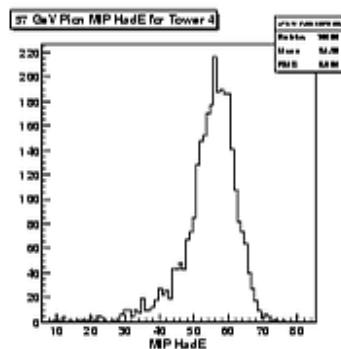
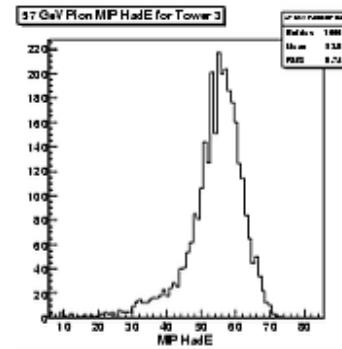
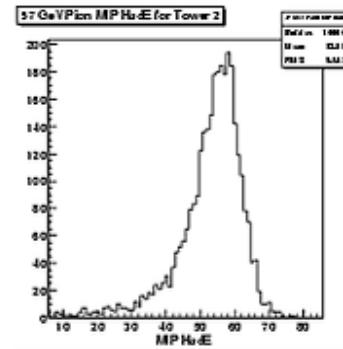
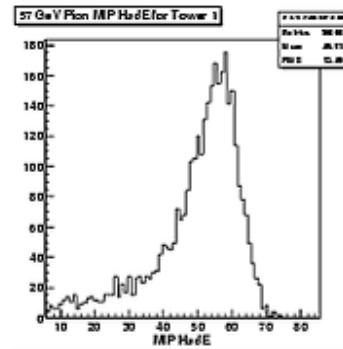
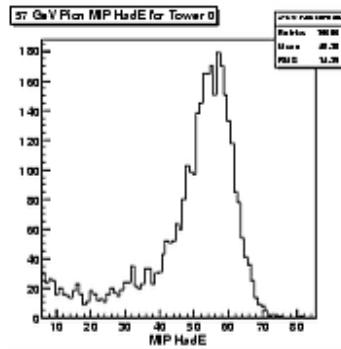
$\langle E_{\text{total}}/p \rangle$ vs. p

Towers 3 & 9



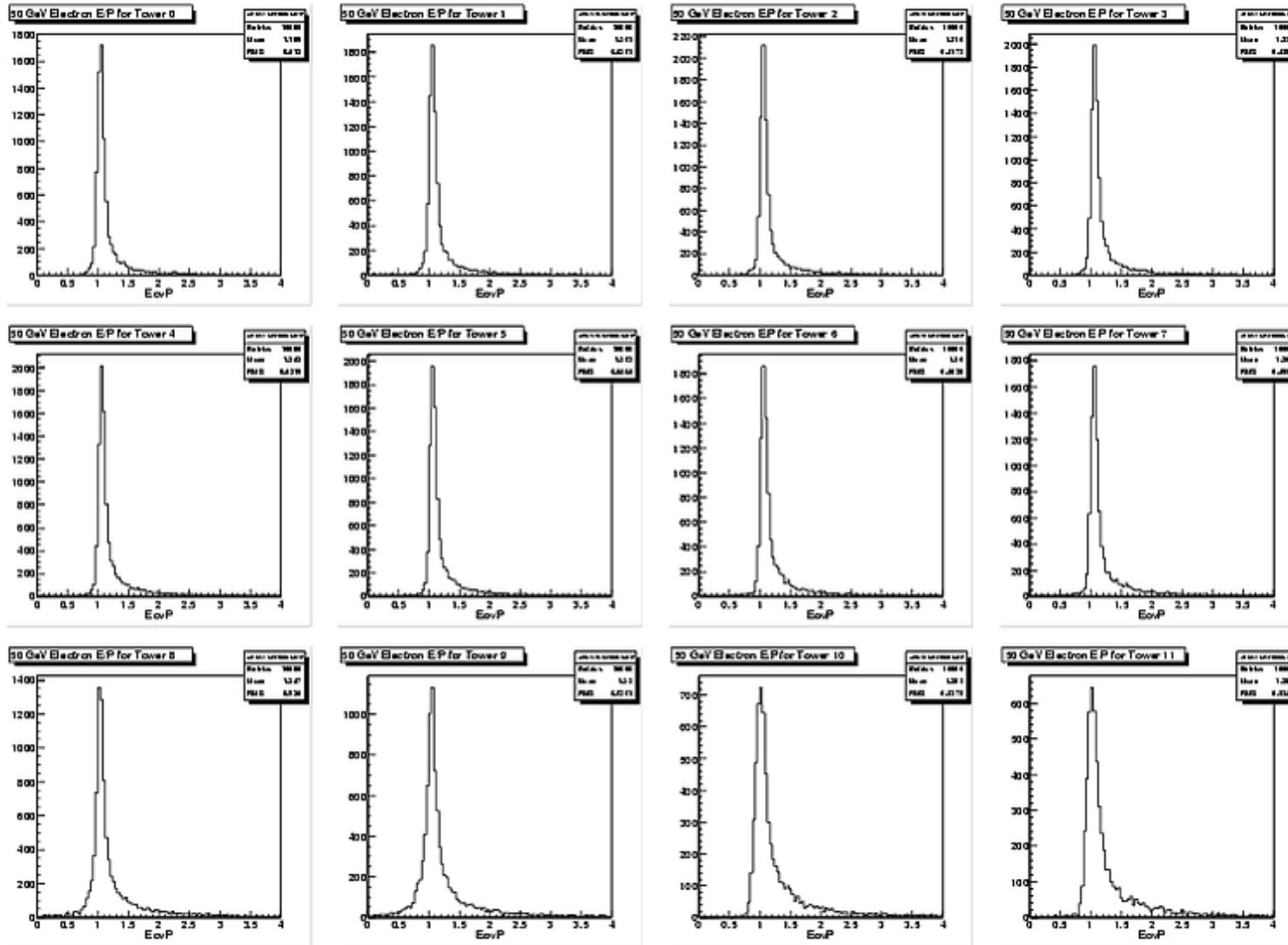
$E_{\text{had}}(\text{MIP } E_{\text{em}} < 0.6)$

$p(\pi) = 57 \text{ GeV}$



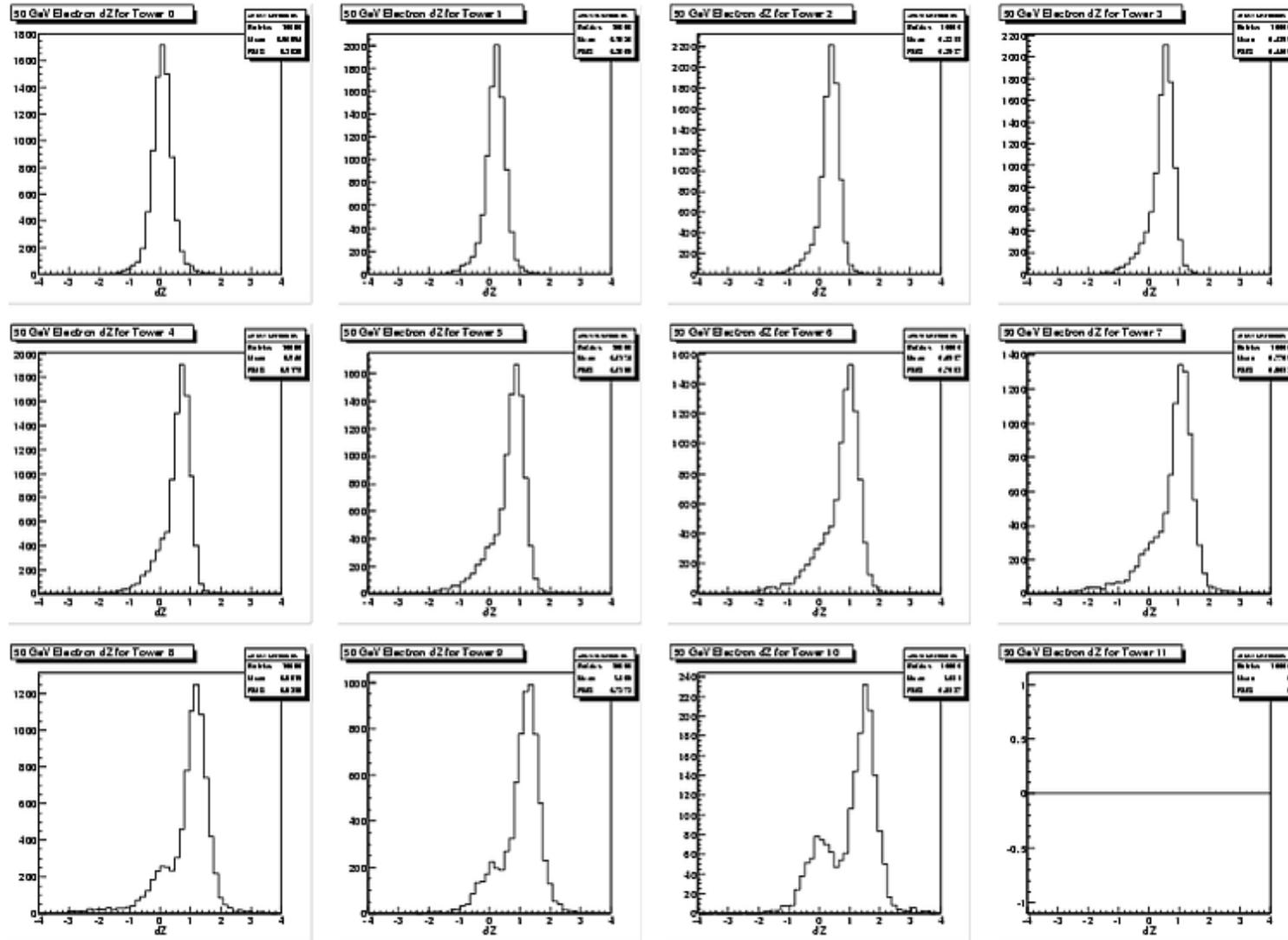
E/p

$p(e) = 50 \text{ GeV}$



CES ΔZ

$p(e) = 50 \text{ GeV}$



How About Now?

- ◆ Calorimeter
- ▶ Muon Systems
- ◆ Silicon, COT
- ◆ Tracking

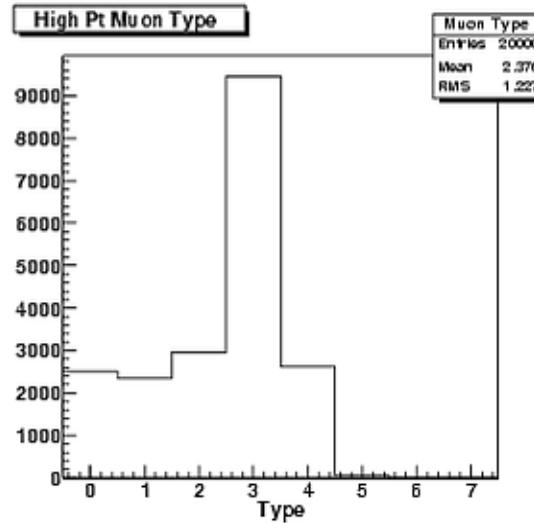
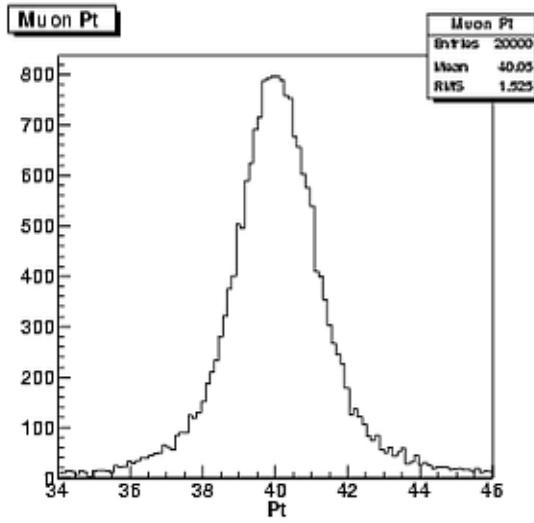
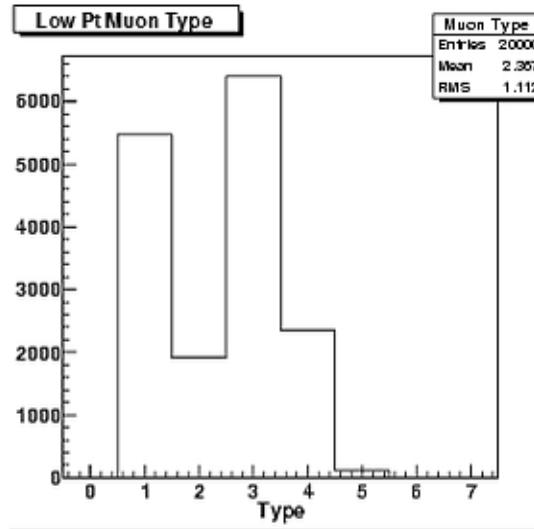
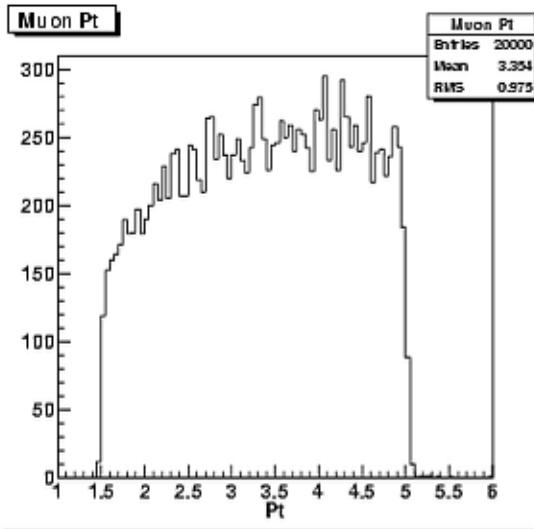
Muon Systems

❖ # muons classified as CMU, CMP,
CMUP, CMX

- For each sub-system

- ◆ ϕ, η
- ◆ track-muon stub $\Delta r\phi, \Delta Z$
- ◆ E_{had}, E_{em}

Muon Type

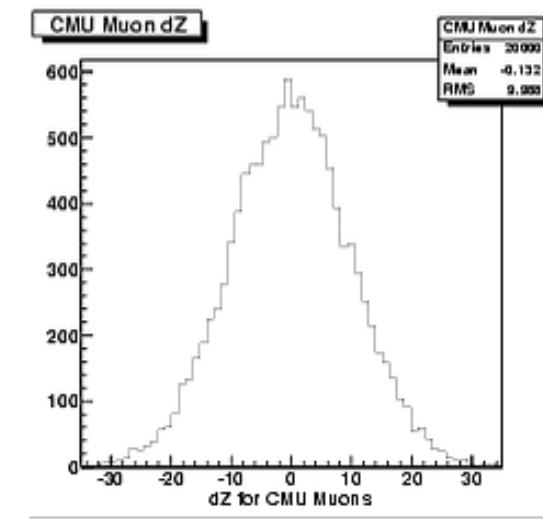
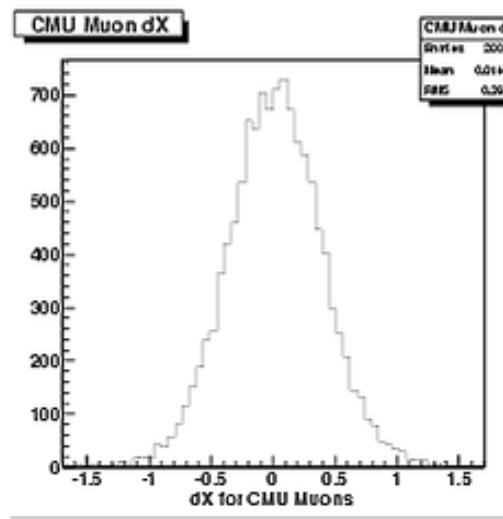
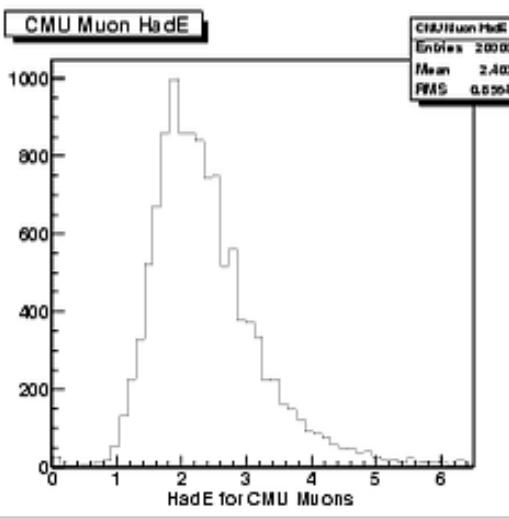
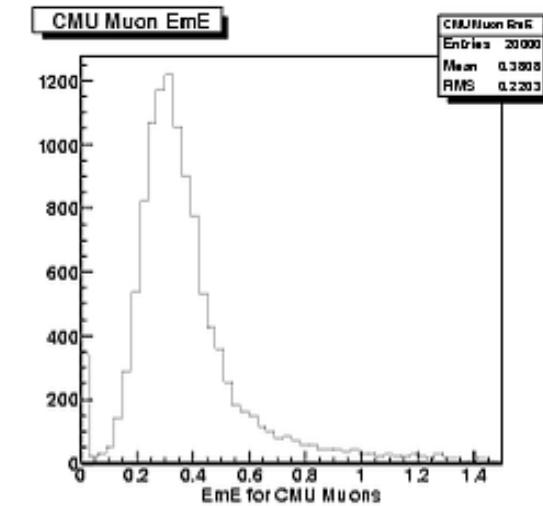
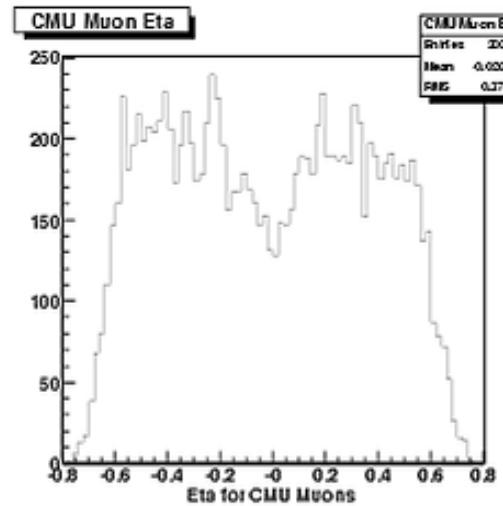
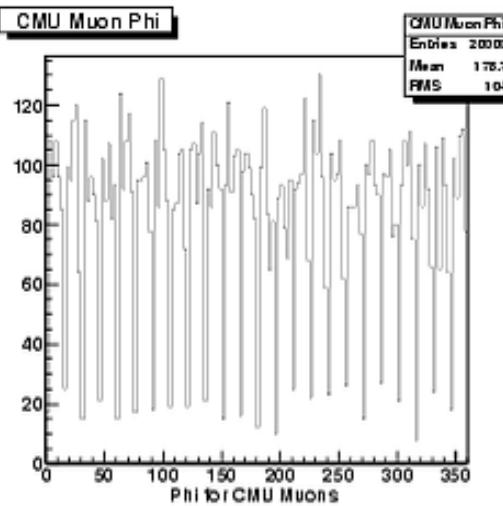


$p(\mu)=1.5-5 \text{ GeV}$

$p(\mu)=40 \text{ GeV}$

CMU Quantities

$$p(\mu) = 40 \text{ GeV}$$



And Now?

- ◆ Calorimeter
- ◆ Muon Systems
- ➡ Silicon, COT
- ◆ Tracking

Silicon, COT

◆ Cluster length & charge

- L00, SVX, ISL layers
 - ◆ Axial, 90°Z, SAS
 - Parametric, geometric, & physical CDMs

◆ #COT hits

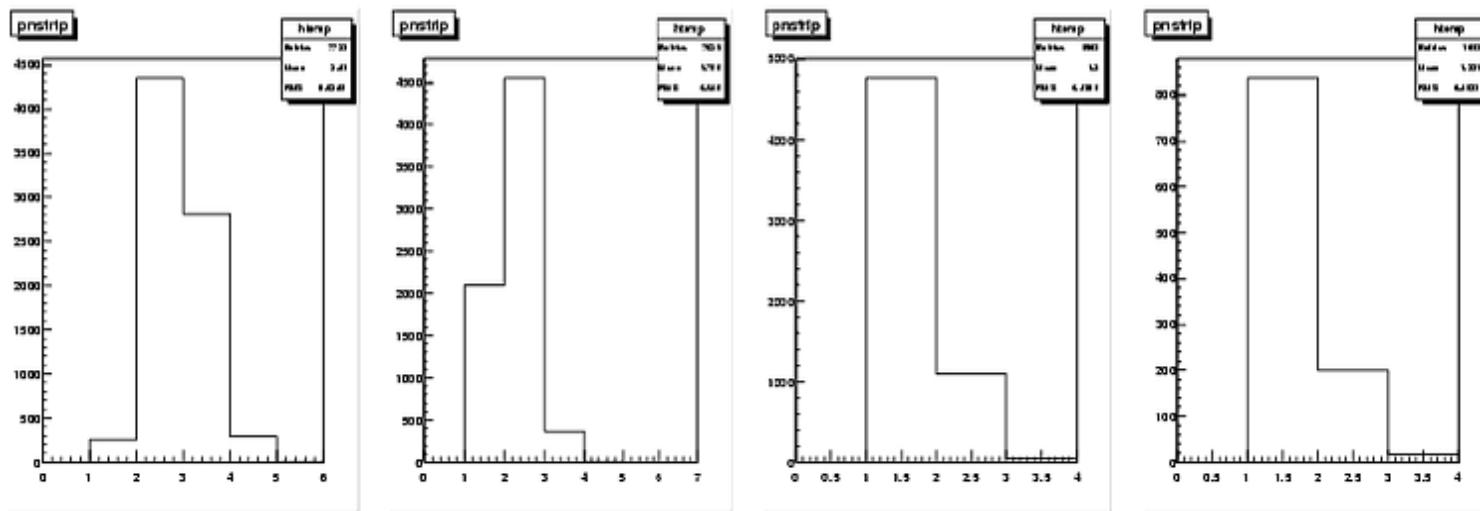
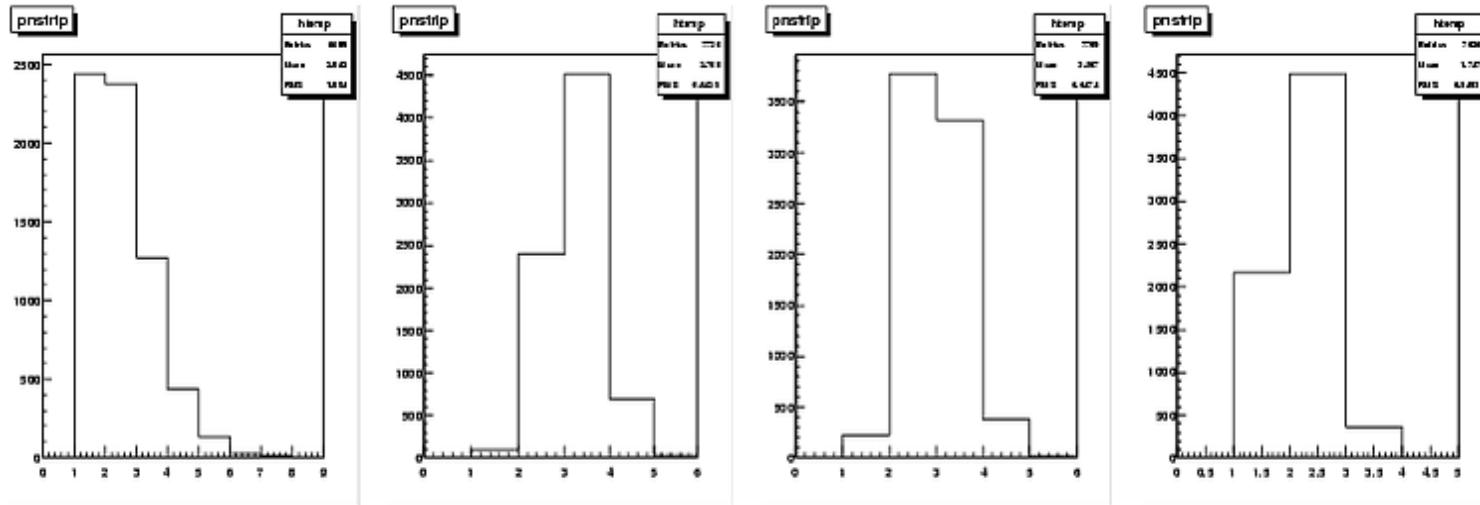
- Total, axial, stereo and per SL
- Hit width

◆ Residuals

- Si true track vs. hit
 - ◆ PropagatedSiParticleColl
- COT hit vs. track displacement

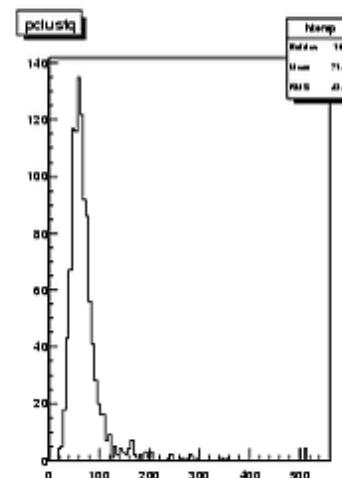
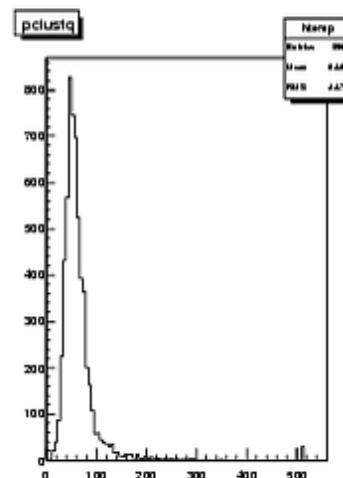
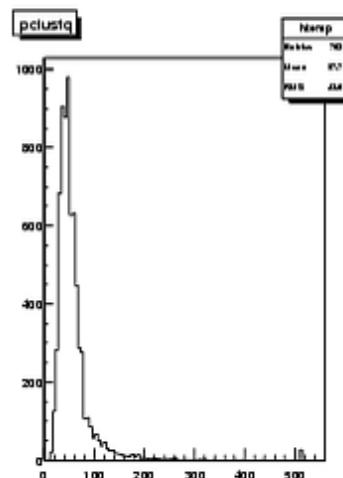
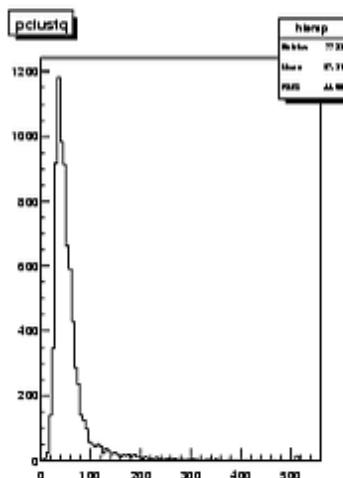
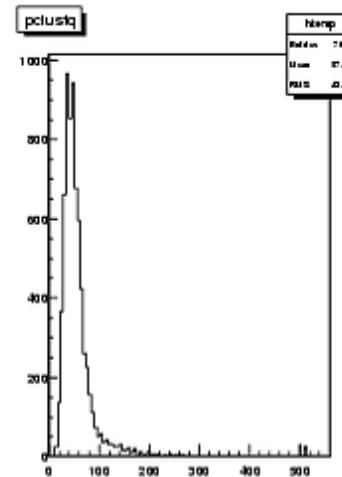
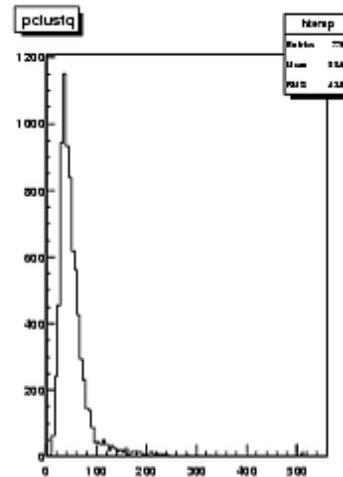
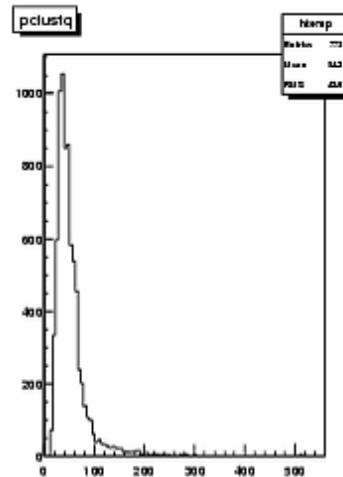
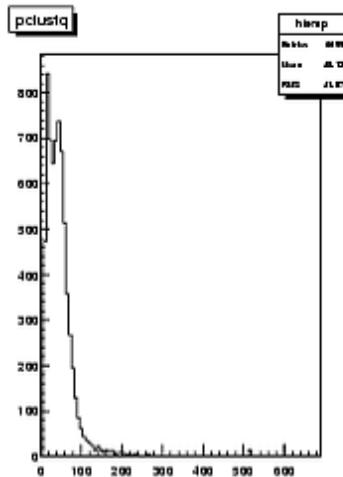
Axial Cluster Length

Parametric charge deposition model



Axial Cluster Charge

Parametric charge deposition model



Are We There Yet?

- ◆ Calorimeter
- ◆ Muon Systems
- ◆ Silicon, COT
- ▶ Tracking

Tracking

- ◆ Herwig ttbar MC
- ◆ Track parameter distributions
 - d_0 , d_0/σ , Q/p_T , Z_0 , φ , $\cot(\theta)$
- ◆ Track multiplicity
 - per event
 - vs. p_T
- ◆ No plots to show today 

Finally... The Summary

- ◆ Calorimeter & muon system validation framework is complete
- ◆ More work to do
 - Tracking
 - Silicon
 - COT
 - Should be completed w/in a week or two... depends when the war ends

